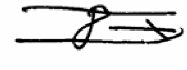
Water Distribution Systems

Components

Linsley Table 15.1 p. 498 elements of water-supply systems

(1) Pipelines
- min dia 6 in
- looped
- ductile iron or plastic

(2) Pumps
- axial



- centrifugal

(3) Flow (Q)

Pressure minimum
- 25 psi in Delaware
- 35 psi. in 10 state standards

(4) Storage
- Tanks (finished, treated water)
- Reservoir (raw water)

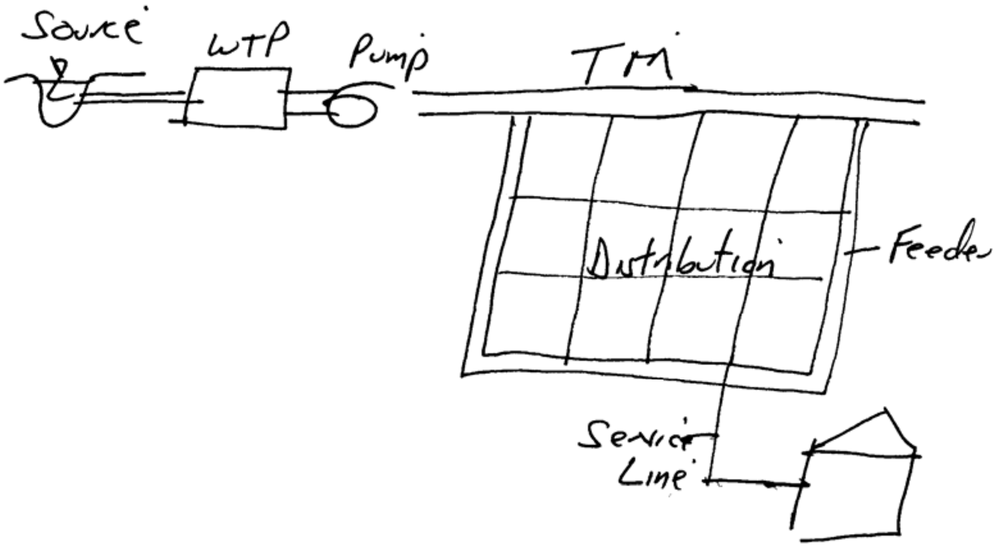
(5) Valves / meters

(6) Treatment Plant

(7) Supply
- Surface water (streams, rivers, lakes)
- Groundwater (wells)

Pipelines

Transmission Mains	(greater than 24")
Feeder	18" - 24"
Distribution	6" - 18"



Pressure

min. 25 psi DE Public Service Commission
35 psi Great Lakes, 10 state standards

Normal 60 - 65 psi

Max 90 psi

Velocity

max = 25 fps
Normal = 5 - 10 fps

Water Demand

Distribution of Water Demand in NCC
(Hurd, 1998)

Category	Demand	% of total
Residential	33	49%
Commercial	14	20
Industrial	12	18
Unaccounted for (loss)	9	13
	68 mgd	100%

Per capita Water Demand

Normal 100 - 150 gpcd

Peak 150 - 300 gpcd

Peaking Factor 1.5 - 2.0

Per dwelling

Normal 300 gpd/du @ 3 people/dU

Peak 450 - 900 gpd/du

(Tidewater, 1998)

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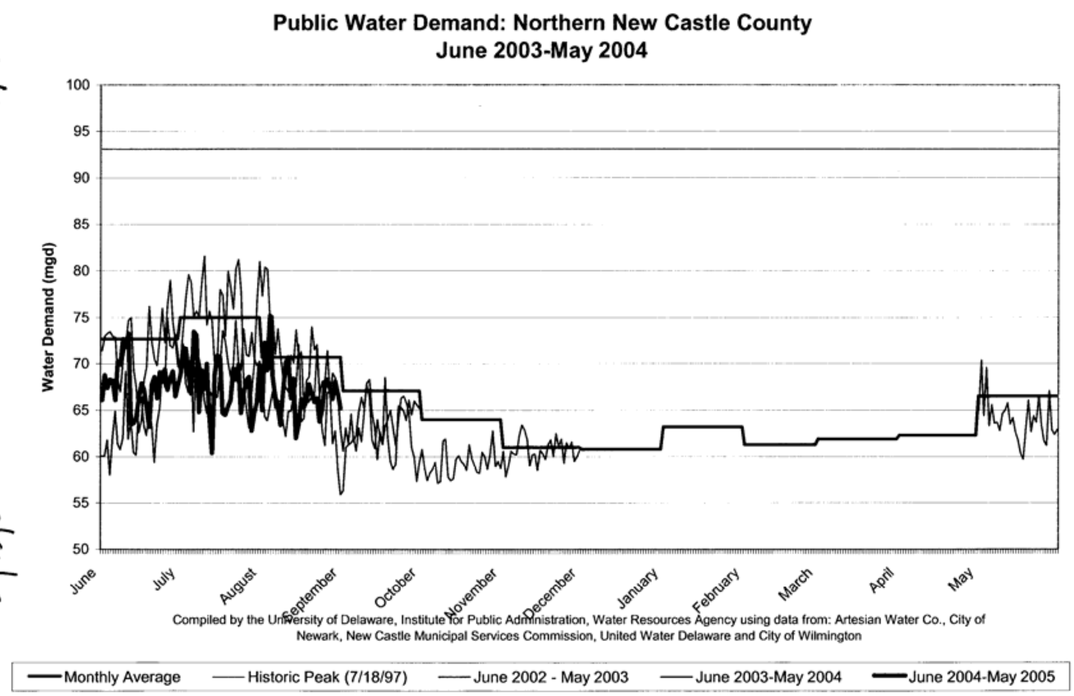

New Castle County Population

		Normal	PF	Peak
1990	450,000 pop. x	150 gpcd = 67.5 mgd	1.5	= 101 mgd
2000	500,000 pop x	150 gpcd = 75 mgd	1.5	= 112 mgd

No. NCC Supply / Demand Projections

Year	(mgd) Supply	(mgd) Demand	+/-	Volume* (mg)
2000	73.0	86.0	-13.0	-780
2010	73.0	88.0	-15.0	-900
2020	73.0	90.0	-17.0	-1,020

*Assumes 60 day drought period

see Fifth Report to Governor & General Assembly
www.wr.udel.edu publications

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Design of Water Tank Storage Volume for the City of Newark

Given: Population of Newark, DE = 28,000
Normal Per Capita Water Use = 150 gpcd
Fireflow Requirement = 5000 gpm over 5 hours

Water Tank Storage Volume Demand = Volume of Demand in Excess of Maximum Daily
+ Fire Storage
+ Emergency Storage for 1 day at Average Daily Demand

= Peaking Factor*(Population)*(Normal Per Capita Water Use)*(Factor of Safety)
+ Fire Flow Rate*(Duration of Fire)
+ Population *(Normal Per Capita Water Use)

= 2.0*(28,000)*(150 gpcd)*(0.25)
+ 5000 gpm*(60 min/hr)*(24 hr/day)*(5hr)*(1 day/24 hr)
+ 28,000*(150 gpcd)

= 2.1 MG
+ 1.5 MG
+ 4.2 MG

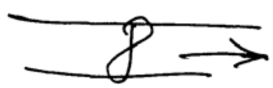
= 7.8 MG

Therefore, total volume of storage tanks in the City of Newark should be 7.8 million gallons. We'll review this in class on Wednesday.

Pumping Stations

- Centrifugal

- Axial



Horsepower:

$$hp = \frac{Q \gamma H}{550}$$

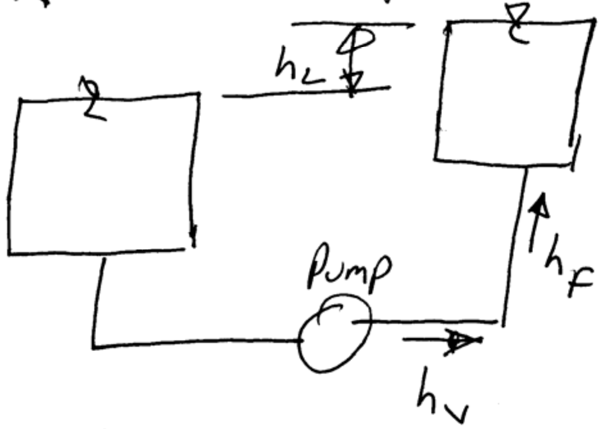
where: Q = Discharge (cfs)
γ = spec. wt.
H = Total Dynamic Head
550 = ft-lb/sec conversion (TDH)

(efficiency) x Actual HP = Theoretical HP

Pumping Head

$$TDH = h_L + h_F + h_V$$

TDH = Total Dynamic head (ft)
h_L = Total static head
h_F = Friction head losses "C"
h_V = Velocity head $\left(\frac{V^2}{2g}\right)$



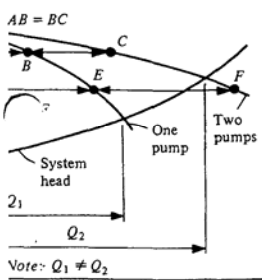
Download EPANET 2 Water Distribution Model

http//www.epa.gov/ORD/NRMRL/wswrd/epanet.html

1. Download executable program
2. Dowload User manual (bookmark)
3. Print out ch. 2, tutorial, only.

mps is between 50 and
... reported. Pump efficiency
pump.[23]

aracteristics and is required
ows. This is done by plotting
characteristic curves. The
ad curve and the pump-head
the pump will be operating.
nt is also as close as possible
5-28.



Discharge

(b)

pump operations of equal pumps.

el. For series operation at a
heads added by each pump.
ied by the number of pumps
when two pumps are used in
a given system head curve is

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●EXAMPLE 5-6

A pumping station is to be designed for an ultimate capacity of 1200 gpm at a total head of 80 ft. The present requirements are that the station deliver 750 gpm at a total head of 60 ft. One pump will be required as a standby.

○***Solution***

(a) The total curve for dynamic head versus discharge is plotted as shown in Fig. 5-29. Values for the curve are obtained as indicated in Sec. 5-11.

(b) Consider that three pumps will ultimately be needed (one as a standby). Determine the design flows as follows:

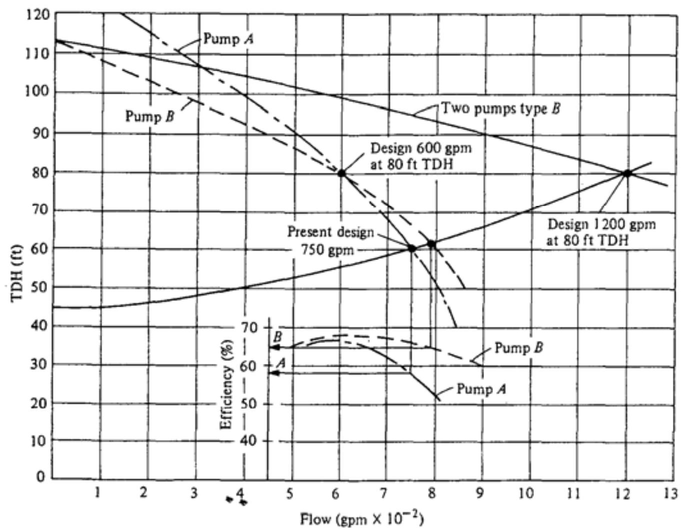

FIGURE 5-29. Solution for Example 5-6.

1. Two pumps at 1200 gpm at 80 ft of TDH
2. One pump at 1200/2 = 600 gpm at 80 ft of TDH
3. One pump must also be able to meet the present requirements of 750 gpm at 60 ft of TDH.

(c) From manufacturers' catalogs, two pumps, *A* and *B*, are found that will meet the specifications. The characteristic curves for each pump are shown in Fig. 5-29. The intersection of the characteristic curves with the system-head curve indicates that pump *A* can deliver 750 gpm at a TDH of 60 ft while pump *B* can deliver 790 gpm at a TDH of 62 ft. A check of the efficiency curves for each pump indicates that pump *B* will deliver the present flow at a much greater efficiency than pump *A*. Therefore, select pump *B*.